

BELLCOMM, INC.

955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D.C. 20024

B70 06088

SUBJECT: Status of Skylab CO₂ Removal System
Case 620

DATE: June 30, 1970
FROM: W. W. Hough

MEMORANDUM FOR FILE

The attached charts were used in a presentation at the ML Review on June 26. The first chart reviews the development of the Skylab CO₂ removal system. Since the fall of 1968, the weight attributable to the system has quadrupled. The current system maintains a reduced CO₂ level of 3 mm Hg, and consequently the humidity level in the Skylab is far below the minimum requirement. This problem has been recently reported by J. J. Sakolosky.*

Candidate systems which would maintain the required CO₂ and humidity levels are listed on the second chart. The third chart gives a weight breakdown for each. Candidate additions to the current system result in further weight increases. A humidifier does not have to be coupled to the existing ECS loop; it can be a totally separate and independent system. Although lighter, the addition of silica-gel water-save beds involves substantial changes to the existing system. A return to an LiOH system is clearly most attractive from the weight standpoint, although internal volume required for canister stowage and increased crew involvement are disadvantages.

If, because of cost and/or schedule limitations, no changes are made, then the stated medical requirements on CO₂ and/or humidity levels must be relaxed. An increase in humidity level can be achieved at the expense of increased CO₂ concentration by decreasing the flow rate through the sieves or operating only one of them.

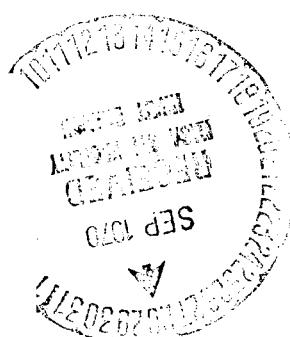
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Attachments
Charts

W. W. Hough

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W. W. Hough

22 (PAGES)	(THRU)	
02(A)	Revised	
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* "The Skylab Humidity Problem and Several Possible Solutions," Bellcomm Memorandum for File, B70 06044, June 15, 1970.

(NASA-CR-113362) STATUS OF SKYLAB CO₂
REMOVAL SYSTEM (Bellcomm, Inc.) 4 p

N79-73087

Unclassified
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HISTORY OF SAA/AAP/SKYLAB CO₂ REMOVAL SYSTEMS

DATE	PROGRAM OR REQUIREMENT CHANGE	CO ₂ REMOVAL SYSTEM BASELINE	WEIGHT
JUNE-OCT, 1966	14 DAY DEPENDENT SSESM BECOMES 30 DAY AM WITH ECS	10 DAYS APOLLO LiOH IN CM 20 DAYS GEMINI LiOH IN AM	425
OCT, 66- JUNE, 67	CLUSTERED AAP CONCEPT EVOLVES, AAP 1-2 & 3-4 DUAL LAUNCH MISSIONS	84 DAYS GEMINI LiOH IN AM PLUS 10 DAYS APOLLO LiOH IN EACH CM	1175
JULY-DEC, 1967	AAP-5 (LATER 3A) ADDED, WEIGHT REDUCTION REQUIRED	MOLECULAR SIEVE ADDED, 28 DAY SUPPLY OF GEMINI LiOH CARRIED, CM SUPPLIES REDUCED	825
SEPT-NOV, 1968	AAP-2 WEIGHT REDUCTION	REDUNDANT MOLECULAR SIEVE REPLACES AM LiOH SYSTEM	625
MAR, 69	AIR-RESEARCH DISCOVERS SIEVE LOSES 3.3 LB/DAY O ₂ & N ₂ INSTEAD OF 1.5 LB/DAY	ALLOWANCE FOR GAS LOST BY DESORPTION GOES UP	925
MAY-JULY, 1969	WORKSHOP CHANGES FROM WET TO DRY	TANKAGE FOR DESORPTION LOSS CHANGES FROM SM CRYO TO AM GASEOUS	1380
OCT, 69	MSC CHANGES CO ₂ PP MAXIMUM FROM 7.6 mm TO 3 mm Hg	OPERATE TWO SIEVES AT 1.5 x FLOW RATE & ADD THIRD FOR REDUNDANCY	2484
APR, 70	SKYLAB DEW-POINT ANALYZED TO BE 29°F vs 45°F MINIMUM REQUIREMENT	NOT RESOLVED	

REQUIREMENTS	CANDIDATE SYSTEMS	TOTAL WEIGHT
		Δ INTERNAL VOLUME REQUIRED
<ul style="list-style-type: none"> • $\text{CO}_2 \text{ PP} \leq 3 \text{ mm Hg}$ • SKYLAB DEW POINT $\geq 45^\circ\text{F}$ 	<ul style="list-style-type: none"> • CURRENT MOL SIEVES AND HUMIDIFIER <ul style="list-style-type: none"> • CHX WATER RECLAIMED • CONTROLLED EQUILIBRIUM DEW-POINT • $\text{CO}_2 \text{ PP} \sim 3 \text{ mm Hg}$ 	3264 LBS – 14 CU FT
	<ul style="list-style-type: none"> • CURRENT MOL SIEVES AND SILICA GEL WATER-SAVE BED • WATER ADSORBED BEFORE ENTERING SIEVE AND RECLAIMED • DEW POINT <ul style="list-style-type: none"> • 48°F WITH ONE CHX • 44°F WITH TWO CHX'S • $\text{CO}_2 \text{ PP} \sim 3 \text{ mm Hg}$ 	2859 LBS – 12 CU FT
	<ul style="list-style-type: none"> • AM LiOH SYSTEM <ul style="list-style-type: none"> • DEW POINT <ul style="list-style-type: none"> • 50°F WITH ONE CHX • 45°F WITH TWO CHX'S • $\text{CO}_2 \text{ PP} < 3 \text{ mm Hg}$ 	1650 LBS – 51 CU FT

WEIGHT BREAKDOWN FOR CANDIDATE SYSTEMS

	CURRENT	AM LiOH
3 MOLECULAR SIEVES	540	CO ₂ & ODOR ABSORBER
8 CHARCOAL CANISTERS	104	LiOH FOR 140 DAYS
N ₂ DESORPTION LOSS	526	LiOH STORAGE STRUCTURE
O ₂ DESORPTION LOSS	398	150
N ₂ TANKAGE PENALTY	916	
O ₂ TANKAGE PENALTY	—	
TOTAL CURRENT	2484	
+ HUMIDIFIER	+ WATER-SAVE BED	
HUMIDIFIER	30	3 WATER-SAVE BEDS
H ₂ O FOR HUMIDIFIER	500	375
H ₂ O TANKAGE PENALTY	250	
TOTAL	3264	TOTAL 2859
		TOTAL 1650

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